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April 6th, 1837.

FRANCIS BAILY, Esq., V. P. and Treasurer, in the Chair.

Robert Hunter, Esq.; John Forbes Royle, M.D.; and Lieut.-J. R. Wellsted, were severally elected Fellows of the Society.

A paper was in part read, entitled, "Further Observations on Voltaic Combinations; in a letter addressed to Michael Faraday, Esq., D.C.L. F.R.S., Fullerian Professor of Chemistry in the Royal Institution, &c. &c." By John Frederick Daniell, Esq., F.R.S., Professor of Chemistry in King's College, London.

April 13, 1837.

FRANCIS BAILY, Esq., V.P. and Treasurer, in the Chair.

William Archibald Armstrong White, Esq., was elected a Fellow of the Society.

The reading of Professor Daniell's paper on Voltaic Combinations was resumed and concluded.

In the course of an inquiry on the effects of changes of temperature upon voltaic action, the author was led to observe some curious disturbances and divisions of the electric current produced by the battery, arising from secondary combinations; the results of which observations form the subject of the present paper. He found that the resistance to the passage of the current was diminished by dissolving the sulphate of copper which was in contact with the copper in the standard sulphuric acid, instead of water. The increased effect of the current, as measured by the voltameter, was farther augmented by the heat evolved during the mixture; and wishing to study the influence of temperature in modifying these effects, the author placed the cells of the battery in a tub, filled with hot water. On charging the cells with a solution of muriate of ammonia in the interior, and aqueous solution of sulphate of copper in the exterior compartment, he observed that a portion of the current is discharged by the water in which the apparatus was immersed; its passage being indicated by the disengagement of gas betwixt the adjacent cells; in which case, one of the zinc rods is thrown out of action, and the copper of that cell acts merely as an electrode to the antecedent zinc. A saturated solution of common salt was

next placed in contact with the zinc, while the exterior compartments of the cells were filled with a saturated aqueous solution of sulphate of copper ; but the effects were much diminished. It thus appeared that the substitution of solutions of the muriates for dilute sulphuric acid was in every way disadvantageous ; and it was moreover found that, when the circuit was broken, the copper became seriously injured by their action, and by the formation of a sub-muriate of that metal.

Finding that the membranous tubes were unable to resist the action of the acid under the influence of high temperatures, the author substituted for them tubes of porous earthenware, of the same texture as that of which wine-coolers are commonly made, closed at their lower ends, and of the same height as the copper cells. The bottoms of the latter were fitted with sockets, for the reception of the tubes, and for confining them in their proper places ; the perforated copper plates, or colanders, which held the solid sulphate of copper, passing over their upper ends. The tubes can be easily removed, and instantly replaced ; and the facility of emptying and refilling them renders the addition of siphon-tubes unnecessary, except in very particular circumstances. A circular steam-vessel of tin plate was then provided, around which the cells could be placed upon blocks of wood, and closed in with a cover, containing a socket, which could, at pleasure, be connected with the steam pipe of a boiler. Two other sockets were also conveniently placed, provided with cork stoppers, through which the electrodes of the battery could pass, when the proper connexions were made. By using this apparatus the author determined that the increase of effect consequent on an augmentation of temperature is but in a slight degree dependent on an increase of conducting power in the electrolyte, but arises principally from its increased energy of affinity, producing a greater electromotive force.

In heating the battery by the steamer, it frequently happened that, when the thermometer had nearly reached the boiling point, and the action of the battery was at its maximum, a sudden cessation of its action would take place ; and this suspension of power would continue for hours, provided the high temperature were maintained. On turning off the steam, and quickly cooling the apparatus, the action would return as suddenly as it had ceased, though, generally, not to the full amount. On closely examining the voltameter, on these occasions, it was found that the current was not wholly stopped ; but that there existed a small residual current. This residual current was observed to be often directed in a course opposite to that which had before prevailed ; and it was, in that case, the excess of a counter current, arising from a force which was acting in the contrary direction. The author found that variable currents might be produced, under ordinary circumstances, from the separate single cells of the battery when the whole series is connected by short wires. He proved by a series of experiments that the deoxidation of the oxide of copper by the hydrogen is not the exciting cause of the secondary currents ; but that when the course of the main cur-

rent of the battery is obstructed by causing it to pass through the long wire of a galvanometer, or through the electrolyte of a voltameter, the course of the secondary current from each separate cell is always normal, or in the same direction: when, on the other hand, the battery-current is allowed to flow with the least possible resistance, as by completing the main circuit by a short wire, the secondary current of the separate cells is in the opposite direction. Hence the resistance may be so adjusted as that the secondary current shall altogether disappear, or alternate between the two directions.

The remainder of the paper is occupied with the detail of experiments made with a view to ascertain the effects of different degrees of resistance to the voltaic currents under a great variety of circumstances.

April 20, 1837.

The Right Honourable the Earl of BURLINGTON, V.P. in the Chair.

Frederic C. Skey, Esq., was elected a Fellow of the Society.

A paper was read in part, entitled, "Observations taken on the Western Coast of North America." By the late Mr. Douglas; with a report on his paper; by Major Edward Sabine, R.A., F.R.S. Communicated by the Right Honourable Lord Glenelg, one of His Majesty's Principal Secretaries of State, F.R.S., &c.

April 27, 1837.

FRANCIS BAILY, Esq., V.P. and Treas., in the Chair.

M. Antoine César Becquerel, Professor C. G. Ehrenberg, Admiral A. J. Von Krusenstern, and the Chevalier C. F. Mirbel, were elected Foreign Members of the Society.

The reading of Mr. Douglas and Major Sabine's paper, was resumed and concluded.

In the report prefixed to this paper, Major Sabine states, that Mr. Douglas was originally a gardener, and was, in the year 1833, recommended by Sir William Jackson Hooker to the late Mr. Joseph Sabine, who was then Secretary to the Horticultural Society of London, as a fit person to be employed by the Society in selecting and bringing to England a collection of plants from the United States of America. Having accomplished this mission to the complete satisfaction of his employers, he was next engaged on an expedition having similar objects with the former, but embracing a much larger field; namely, the tract of country extending from California to the highest latitude he might find it practicable to attain on the western side of the Rocky Mountains. Anxious to render to geographical and physical science all the services in his power, and to avail himself for that purpose of every opportunity which his visiting these hitherto imperfectly explored regions might afford him, he now endeavoured by diligent application to supply the deficiencies of his previous education. During the three months

which preceded his departure from England, he studied with unremitting ardour and perseverance for no less than eighteen hours each day; and, conquering every difficulty, acquired a competent knowledge of the principles of science, learned the uses of various instruments, and made himself thoroughly master of the methods of taking observations both at sea and on land.

The narrative proceeds to notice the arrival of Mr. Douglas in America, the progress of his undertaking, the loss of his collections and most of his books and papers, by the upsetting and dashing to pieces of the canoe in which he attempted to pass the rapids, and, lastly, his death in 1833, at Owhyhee, in the Sandwich Islands, whither he had proceeded on his return to Europe.

The books which were preserved, and which have been received by Major Sabine, consist of several volumes of Lunar, Chronometrical, Magnetical, Meteorological and Geographical observations, together with a volume of field sketches. The geographical observations of latitude and longitude refer to two distinct tracts of country; first, the Columbia river, and its tributaries; and the district to the westward of them: and, secondly, California. Mr. Douglas very judiciously selected the junctions of rivers, and other well characterized natural points, as stations for geographical determination. The papers containing the details of his magnetical inquiries comprise records of observation of the dip, and of the intensity, at various stations both in North America and in the Sandwich Islands.

“Analysis of the Roots of Equations.” By the Rev. R. Murphy, M.A. Communicated by John William Lubbock, Esq., F.R.S.

The object of this memoir is to show how the constituent parts of the roots of algebraic equations may be determined by considering the conditions under which they vanish; and, conversely, to show the signification of each such constituent part.

The following are the propositions on which the author's investigations are founded.

1. In equations of degrees higher than the second, the same constituent part of the root is found in several places, governed by the same radical sign, but affected with the different corresponding roots of unity as multipliers.

2. The root of every equation, of which the coefficients are rational, contains a rational part; for the sum of the roots could not otherwise be rational. This rational part, as such, is insusceptible of change in the different roots of the same equation; consequently its value is the coefficient of the second term, with a changed sign, divided by the number of roots, or index of the first term.

3. The supposed evanescence of any of the other constituent parts, implies that a relation exists between the roots; and if such a relation be expressed by equating a function of the roots to zero, that constituent part will be the product of all such functions, and a numerical factor.

4. The joint evanescence of various constituent parts, implies the coexistence of various relations between the roots, and that an in-

terpretation may be given to each of the constituent parts, riveting the expression of the root in the memory, and converting the solution of a problem into a condensed enunciation of various theorems. The author exhibits the application of these principles to equations of various degrees, beginning with quadratic and cubic, and proceeding to those involving higher powers.

"On the first changes in the Ova of the Mammifera, in consequence of Impregnation; and of the mode of origin of the Chorion." By Thomas Wharton Jones, Esq. Communicated by Richard Owen, Esq., F.R.S.

The author having, in a former paper, described the structure of the unimpregnated ovum of mammiferous animals, now proceeds to investigate the changes which the ovum undergoes in consequence of impregnation. In the rabbit, the first perceptible difference is the addition of a thick gelatinous matter surrounding the parts of which the ovum was composed in its original state, and apparently derived from the ovaries. In the progress of development the vitellary membrane gives way, as happens in the ova of the newt, and of many of the oviparous animals. The gelatinous envelope acquired in the ovary, and which is more especially circumscribed and defined after impregnation, constitutes the only covering of the vascular blastodermis, after the giving way of the vitellary membrane, and afterwards forms the chorion, which in rodent animals, at a further stage of development, presents itself under the form of a thin and transparent membrane, very similar to the vitellary membrane of a bird's egg, and situated immediately outside the non-vascular and reflected layer of the umbilical or erythroid vesicle. The author draws similar conclusions with regard to the developement of the human ovum.

The second part of the paper relates to the changes taking place in the vitellus, the inferences concerning which are deduced chiefly from observations of the developement of the ova of batrachian reptiles. The author concludes that the disappearance of the germinal vesicle is prior to impregnation. In the newt, the vesicle, at first imbedded in the substance of the yelk, gradually approaches the surface, until its situation is immediately underneath the vitellary membrane: its coat, having now become very soft, gives way, allowing the contained fluid to be effused on the surrounding surface of the yelk; and the small depression in which the vesicle was lodged now forms the cicatrix. The effused fluid gives a degree of consistence to the matter composing the surface of the yelk, and thus promotes the formation of the blastodermis. In the frog, the surface of the yelk becomes every day more and more broken up, and the resulting crystalline forms described by Prevost and Dumas become smaller and smaller, until the surface of the black blastodermis appears under a magnifying glass like shagreen. The blastodermis, consisting of an aggregation of clear globules, different from those of the rest of the yelk, is now fully formed, and has extended itself so as to close in the white spot. The change which takes place in the yelk of the bird's egg appears to be limited to the neighbourhood of the cicatrix.

May 4th, 1837.

FRANCIS BAILY, Esq., V.P. in the Chair.

"On the adaptation of different modes of illuminating Light-houses, as depending on their situations and the object contemplated in their erection." By William Henry Barlow, Esq., in a Letter addressed to Peter Barlow, Esq., F.R.S., and communicated by him.

The letter of Mr. W. H. Barlow, addressed to his father, in which the paper is contained, is dated Constantinople, March 14th, 1837, and states that the experiments which he made with the Drummond light, and other means of illuminating Light-houses, and of which he now communicates the results, were undertaken at the request of the Turkish Government, with the view of placing lights at the entrance of the Bosphorus from the Black Sea. The object of his inquiry is to investigate the principles on which the illuminating power, resulting from the employment of reflectors, and of lenses, depends; and the most advantageous application of that power to the purposes of Light-houses.

In discussing the relation which exists between the illuminating power and the intensity of an artificial light, he observes that the former is proportional to the quantity of light projected on a given surface at a given distance; and that the latter is dependent on the quantity of light projected by a given area of the luminous body on a given surface at a given distance. Hence the intensity of a light multiplied into its surface is the measure of the illuminating power, whether the light proceed from one or from several luminous bodies: and the illuminating power is equal to that of a sphere of light, whose intensity and apparent surface are equal to that of the light itself at any given mean distance.

Within a certain limit of distance, the property of light which produces the strongest impression on the eye, is its intensity; but when the light is so remote that the angle subtended by it at the eye is very minute, as is generally the case in Light-houses, the intensity of the impression made on the retina is proportional only to the illuminating power. The mathematical investigations of the author lead him to the conclusion that all reflectors and lenses of the same diameter have the same illuminating power when illuminated by the same lamp; and that by diminishing the focal distance, and intercepting more rays, the illuminating power is not increased, but simply the divergence, and consequently the surface or space over which it acts. The author then proceeds to inquire into the comparative utility of lenses and reflectors, and arrives at the inference that the advantage gained by the employment of the former does not arise from their superior perfection as optical instruments, but from their using the light more economically, in consequence of their producing less divergence of the rays, both horizontally and vertically, and illuminating a much smaller space in the horizon. Rules are then deduced for the application of lenses and reflectors in Light-houses, according to the particular situations in which they are placed, and the purposes they are intended to

serve. With this view, the author divides Light-houses into three classes: the first comprising Beacon or Warning Lights, placed in order to prevent the approach of vessels, and which consequently can never be nearer than three or four miles; the second being Guiding or Leading Lights, placed to guide a vessel, and therefore admitting of a very near approach; and the third including those which, according to the respective directions in which they are seen, have both these duties to fulfil. In the first we require great illuminating power, and a long duration of the brightest period, with a small angle of vertical divergence; in the second, less illuminating power, but a larger angle of vertical divergence are requisite, while the duration of the extreme brightness is of minor importance; and in the third, all these properties, namely, great illuminating power, a long duration of the brightest period, and a large angle of vertical divergence, are necessary.

May 11, 1837.

WILLIAM LAWRENCE, Esq., V.P., in the Chair.

Henry S. Boase, M.D., and William Tierney Clark, Esq., were elected Fellows of the Society.

A paper was in part read, entitled, "On the connexion between the Phenomena of the absorption of Light and the Colours of thin Plates." By Sir David Brewster, K.H., F.R.S.

The Society then adjourned over the Whitsun week, to meet again on the 25th instant.

May 25, 1837.

FRANCIS BAILY, Esq., V.P. and Treasurer, in the Chair.

The Rev. William Walton and Richard Westmacott, jun., Esq., were elected Fellows of the Society.

Sir David Brewster's paper was resumed and concluded.

The phenomena of the absorption of light by coloured media have been regarded by modern philosophers as inexplicable on the theory of the colours of thin plates, and therefore irreconcilable with the Newtonian hypothesis, that the colours of natural bodies are dependent on the same causes as the colours of thin plates. The discovery by Mr. Horner of a peculiar nacreous substance possessing remarkable optical properties, of which the author has already given an account, furnished him with the means of instituting a more accurate comparison between these two classes of phenomena. By a careful and minute analysis of the reflected tints of its first three orders of colours exhibited by a single film of the above-mentioned substance, they were found to consist of that part of the spectrum which gives the predominating colour of the tint mixed with the rays on each side of it. In analysing the transmitted beam, bands of the colours complementary to the former are seen, with intervening dark bands; and when the analysis is made with a high magnifying power, the

spectrum is observed to be crossed throughout its whole extent with alternate dark and coloured bands, increasing in number and diminishing in magnitude with the thickness of its plate. In the phenomena of periodical colours there are three peculiarities demanding notice; first, that the dark lines change their places by varying the inclination of the plate; secondly, that two or more lines never coalesce into one; and thirdly, that the colour of the luminous bands in the complementary spectrum are the same as those of the original spectrum when the thin plate is perfectly colourless. The author institutes a comparison of these phenomena with those of absorption as exhibited by a solid, a fluid, and a gaseous body; employing as an example of the first, smalt blue glass; of the second, the green sap of vegetables; and of the third, nitrous acid gas. No connecting link between these phenomena appeared to exist, excepting that both exhibited a divided or mutilated spectrum; but even this common fact has not the same character in both. The nacreous substance described by Mr. Horner, however, in some cases, when the plates were small, was found to produce bands perfectly identical with those of thin plates; while in other cases the bands were exactly similar to those of coloured media. By employing the iridescent films of decomposed glass, the author obtained combinations of films which gave, by transmitted light, the most rich and splendid colours, surpassing every thing he had previously seen among the colours either of nature or of art. These facts have proved that the transmitted colours, though wholly unlike those of thin plates, are yet produced by the same causes, and are residuary, and generally complementary to the sum of the reflected tints. Thus the author has succeeded in completely identifying in their primary features the two classes of facts; the one resulting from absorption, the other from periodic action. The minor points of difference, namely, the uniformity of the bands and tints of absorbing media at all incidences, and the non-appearance of the reflected tints in such media, are endeavoured to be explained by the introduction of several considerations, the complete discussion of which the author reserves for the subject of a future paper. From the phenomena of thin plates, of polarized tints, and of absorption, the existence of a new property of light is deduced, in virtue of which the reflecting force selects out of differently coloured rays of the same refrangibility rays of a particular colour, allowing the others to pass into the transmitted ray; a principle not provided for in either of the theories of light to which the phenomena of absorption are ultimately referable, and furnishing an explanation of certain remarkable phenomena of dichroism in doubly refracting bodies, in which rays of the same refrangibility, but of different colours, pass into the ordinary and extraordinary pencils.

A paper was read "On the hereditary instinctive propensities of Animals." By Thomas Andrew Knight, Esq., F.R.S.

The author adduces, in support of the principle he had advanced in his paper on the economy of bees, namely, that instinctive propensities to the performance of certain actions are transmitted, inde-

pendently of education, from the parent to its offspring, several facts which have fallen under his observation in the course of various experiments commenced by him nearly sixty years ago and continued to the present time. He relates that a young terrier, whose parents had been trained to destroy pole-cats, and a young springing spaniel, whose ancestors through many generations had been employed in finding woodcocks, were reared together as companions; and that each of them, immediately on seeing, and for the first time in its life, the particular prey to which it was guided by hereditary instinct, pursued it with intense eagerness, while it did not appear to notice that which attracted its companion. In several instances he found that young springing spaniels, wholly inexperienced, were very nearly as expert in finding woodcocks as their well-trained parents. The habits of the woodcock have in the course of the last sixty years undergone considerable change, the fear of man having during that period become much stronger by transmission through many successive generations. The author believes that by continued education these hereditary propensities might be suppressed and others substituted: thus the habits of the springing spaniel would never have been acquired, if shooting on the wing had not been practised by man. A young dog, of the variety usually called *retrievers*, on account of their being trained to find and recover wounded game, performed this office, although wholly untaught, quite as well as the best-instructed dog. The male and the female parents appear to possess similar powers of transmitting to their offspring these hereditary feelings and propensities; excepting in the case of hybrid progeny, in which the author thinks he has witnessed a decided prevalence of the character of the male parent. With regard to dogs, the influence of one or other of the parents, and sometimes of both, may occasionally be traced, but without any constancy as to the particular predominance of either sex.

A paper was read "On Meteorological deductions from Observations made at the Observatory at Port Louis in the Mauritius, during the years 1833, 1834, and 1835." By John Augustus Lloyd, Esq., Surveyor-General of that Island, F.R.S. Communicated by Captain Beaufort, R.N., Hydrographer to the Admiralty, F.R.S.

The observations, from which the results recorded in the present paper were made, are nearly 50,000 in number, and were taken four times each day, at the hours of 8 A.M. noon, 4 and 8 P.M. The details of the observations themselves are about to be forwarded to the Royal Society; they relate to the states of the barometer, thermometer, hygrometer, rain gauge, and the appearance of the atmosphere with regard to clearness or cloudiness.

June 1, 1837.

FRANCIS BAILY, Esq., V.P. and Treasurer, in the Chair.

William Ayrton, Esq., James Carson, M.D., William Hopkins, Esq., M.A., and Captain John Thomas Smith, were severally elected Fellows of the Society.

A paper was read, entitled, "On the development and extinction of regular doubly refracting structures in the crystalline lenses of animals after death." By Sir David Brewster, K.H., L.L.D., F.R.S.

Since the year 1816, when the author communicated to the Royal Society an account of the doubly refracting structures which exist in the crystalline lenses of fishes and other animals, he has examined a great variety of recent lenses with the view of ascertaining the origin of these structures, the order of their succession in different lenses, and the purpose which they answer in the animal economy. He had discovered in the lenses of many fishes the alternation of portions, exerting, the one a positive, and the other a negative refractive action; but in his subsequent investigations he met with the greatest discrepancy as to the regularity of their arrangement. He found that in quadrupeds the central structure is positive; while in fishes, where there are three structures, it is always negative; but their positive structure in the former case sometimes exists alone, with faint traces of a negative structure, and sometimes it is followed by another positive structure separated from the first by a black neutral circle, in which the double refraction disappears; at other times various other combinations of these structures are presented. Occasionally, in the dark neutral line which separated two positive structures, he perceived a trace of an intervening structure, which seemed to be either about to disappear or about to be developed. This conjecture was satisfactorily verified by a series of observations which he made on the lenses of the sheep, the ox, and the horse, at different ages, and also on the same lens, during the spontaneous changes it undergoes when kept in distilled water. The negative structure was in these experiments gradually developed at the space intervening between the portions of the lens which had possessed the positive structure; and thus the same parts assumed in succession doubly refractive actions of opposite kinds. The author intimates his intention of pointing out, in a separate paper, the conclusions deducible from these facts respecting the cause and cure of cataract.

June 8, 1837.

WILLIAM LAWRENCE, Esq., V.P., in the Chair.

Robert Bigsby, Esq., George Edward Frere, Esq., and Captain Joseph Ellison Portlock, R.E., were elected Fellows of the Society.

A paper was in part read, entitled "Observations on the minute structure of the higher forms of Polypi, with observations on their classification." By Arthur Farre, M.B. Communicated by Richard Owen, Esq., F.R.S.

June 15, 1837.

FRANCIS BAILY, Esq., V.P. and Treasurer, in the Chair.

James F. W. Johnston, Esq., A.M., was elected a Fellow of the Society.

The following papers were then read, viz.:

"Observations on the minute structure of some of the higher forms of Polypi, with views of a more natural arrangement of the class." By Arthur Farre, M.B., Lecturer on Comparative Anatomy at St. Bartholomew's Hospital. Communicated by Richard Owen, Esq., F.R.S., was resumed and concluded.

After a short account of the labours of preceding naturalists in that department of zoology which comprises the various kinds of polypes, and of the different characters on which they have founded the classification of these animals, the author proceeds to the statement of his own observations on several species which had not been previously investigated with sufficient minuteness and care. Two of the species described he believes to be entirely new, and he has accordingly given them the names of *Bowerbankia densa*, and *Lagenella repens*. The other species which are the subject of the author's investigation, are *Vesicularia spinosa*, *Valkeria cuscuta*, *Alcyonidium diaphanum*, *Membranipora pilosa*, and *Notania loriculata*.

He then discusses the principles on which the classification of this tribe of zoophytes should be founded, and proposes on these principles to give the name of *Ciliobrachiata* to the whole group of polypes characterised by the possession of ciliated tentacula, and a free alimentary canal with two orifices: this group again he divides into two subordinate groups, namely, the *Hydriform* and the *Actiniform*, or *Zoanthiform* polypes. Under the title of *Nudibrachiata* he proposes to comprehend all those polypes which partake of the nature of the hydra, and whose tentacula are unprovided with cilia, corresponding to the *Anthozoa* of Ehrenberg.

"On the Temperature of Insects, and its connexion with the functions of Respiration and Circulation." By George Newport, Esq. Communicated by P. M. Roget, M.D., F.R.S.

The author states at the commencement of his paper, that, although it has been long known that insects living in society, as the bee and the ant, maintain in their habitations a temperature higher than that of the open air, the fact had never yet been established that individual insects of every kind possess a more elevated temperature than that of the medium in which they reside, and that in each species the degree of elevation varies in the different stages of their existence. He was first led to study the temperature of insects in consequence of the curious results which he had met with in some observations he had himself made, in the autumn of the year 1832, on a species of wild bee in its natural haunts, with a view to ascertain, as had been suggested to him by Dr. Marshall Hall, the relation between the temperature of these insects during their hybernation, and the irritability of their muscular fibre: but the fact of the existence of a higher temperature in individual insects had been ascertained by himself prior to these observations; the results of which observations, together with other facts connected with the physiology of insects, he subsequently communicated to Dr. M. Hall.

Since the time when the author has been engaged in the prosecution of this inquiry, some observations on the same subject have been published by Dr. Berthold, of Göttingen, who expresses it as his opinion that insects ought not to be regarded as cold-blooded animals, but who does not appear to have detected the existence of a temperature higher than the surrounding medium in any individual insect. The author also notices the observations on this subject made by Hansmann, Juch, Rengger, Dr. John Davy, and others, some of whom have detected, while others have not observed, the existence of an increased temperature in this class of animals. He then gives a detailed account of the precautions to be taken for ensuring accuracy in making observations of this kind; and remarks that greater reliance is to be placed on those made on the external than on the internal temperature of the animal, seeing that comparative results are all that can be obtained, and that the injury inflicted on the insect by its mutilation very materially interferes with the correctness of the conclusions as to the degree of internal temperature.

After premising these introductory remarks, the author gives a detailed account of his observations on the temperature of insects in their several states of larva, pupa, and imago, from which it appears that those which possess the highest temperature are always volant insects, and are chiefly diurnal species, residing almost constantly in the open air. He shows that the larva has a lower temperature than the imago, and that the energy of its respiration is also less, regard being had to the activity of the insect, and to the size of its body. In lepidopterous insects the average elevation of temperature above that of its surrounding medium, is in the larva from $0^{\circ} \cdot 9$ to $1^{\circ} \cdot 5$; while in the imago it is from 5° to 10° . Among the hymenoptera it is from 2° to 4° in the larva, and in the imago from 4° to 15° or even 20° ; but in all cases the amount of this elevation is shown to depend on the degree of activity, and the quantity of air respired during a given period. The author then inquires into the influence of various circumstances, such as inactivity, sleep, hybernation, and inordinate excitement, on the temperature of insects; and shows that the evolution of heat gradually diminishes in a degree corresponding to the length of time during which the insect remains in a state of repose, but that it is immediately increased as soon as the insect is roused into action. He adverts also to the remote cause of hybernation, which he ascribes, in every state of the insect, to accumulations of adipose matter, or of nutrient fluid, which, being stored up in the system, induce a plethoric state, from which the animal is aroused when this store of materials has been exhausted. A variety of experiments are related, tending to prove that a large proportion of the heat evolved by an insect, when in a state of great activity, is dissipated into the surrounding medium, and that the quantity of heat so generated bears definite relations to the habits, the locality, and the energy of respiration in each respective species of insect. Volant insects, he finds, have the highest temperature; and of these the diurnal bear a higher temperature than the crepuscular; next

to these must be placed the diurnal terrestrial, and last of all the nocturnal terrestrial species.

In the next division of this paper the author considers the temperature of those insects which live in societies; and in particular of the humble bee and the hive-bee. His observations are confirmatory of many of those of Huber relating to the incubating habits of the former of these species; and he has farther ascertained that during the act of incubation the bees possess a voluntary power of generating heat, whereby the temperature of their bodies is raised, apparently for the purpose of imparting warmth to the young in the cells; that this process is accompanied by accelerated respiration; and that the amount of heat evolved is proportional to the quantity of air respired. The law established by Dr. Edwards in the case of the young of mammiferous animals, namely, that they possess less power of generating heat, and that for a certain time they are unable to maintain their usual temperature, is shown by the author to be equally applicable to the early stage of insect life, and also to the perfect insect immediately after its developement from the pupa.

The temperature of the hive-bee is next examined, and it is shown, contrary to the statements of Reaumur, Huber, and others, that bees do not maintain a very high temperature in their hives during winter, but that they are disposed, when not disturbed by any occasional vicissitudes of atmospheric temperature, to assume the state of hibernation; although, on the other hand, when the bees are much disturbed, the temperature of the hive may, even in the midst of winter, become greatly raised. The temperature of the hive is lowest in January, and gradually increases up to the period of swarming, in May or June, after which time it diminishes. A table is given exhibiting the results of successive observations on the influence of the diminution of heat and of light which attended the progress of the annular eclipse of the sun on the 15th of May, 1836, on the temperature of the hive.

It appears from the inquiries of the author that different parts of the hive do not preserve the same relative heat among one another at different periods, and also that the amount of free heat in the hive is often 10° or 15° , even in the months of July and August.

The remaining division of the paper is devoted to the consideration of the connexion existing between the developement of heat and the functions of respiration, circulation, and digestion. The state of the pulse during all the different stages of the larva until its metamorphosis into the pupa is examined with great minuteness, and the results are given in a tabular form. The author traces the rate of pulsation during different conditions of repose and activity, and the corresponding frequency of respirations, and finds that although there is a general accordance between the activity of these two functions, yet that the activity of respiration and the quantity of heat evolved do not depend primarily on the velocity of the circulation, but that under all circumstances the quantity of heat developed is exactly proportional to the quantity of respiration. While the insect is feeding, and digestion is going on, the evolution of

heat increases, and while it is fasting it diminishes; but this diminution has a limit, whereas increased respiration is invariably attended by increased heat. Gaseous matter is exhaled in great abundance from the surface of the body of an insect, and contributes to regulate and equalize its temperature; but the quantity diminishes in proportion to the length of time during which it has been deprived of food. The author maintains that animal heat is not an effect of mere nervous influence, either general or ganglionic; an opinion which he derives from the following considerations: first, that in many insects in which considerable degrees of heat are evolved, and the respiration is energetic, the nervous system is small compared with that of others in which the respiration is less vigorous; and secondly, that if the evolution of animal heat were dependent on the existence of ganglia, the leech ought to generate more heat than the larva of the Lepidoptera, since it has a much greater number of ganglia. Hence he is disposed to draw the general conclusion that animal heat results directly from the changes which take place during respiration; and that the reason why so large a quantity passes off so rapidly from the body of an insect is because it does not become latent, since the circulating fluid, unlike what takes place in the higher animals, is neither completely venous nor completely arterial, but of a character intermediate between both.

Twenty-one tables are annexed exhibiting the records of the experiments referred to in the paper on the respiration, temperature, and circulation of insects.

“Observations on the Dry-rot of Ships, and an effectual method to prevent it pointed out.” By James Mease, M.D. Communicated by Charles Konig, Esq., For. Sec. R.S.

The method recommended by the author for preventing the occurrence of the dry-rot in ships is to impregnate the timbers and planks with common salt, as is practised by the ship-builders in Philadelphia. For this purpose all the spaces between the timbers and the outside and inside planks are to be filled with Spanish or Portugal salt, driven down as the filling proceeds. The salt is found to penetrate thoroughly, and completely to saturate the wood, combining with its native sap and preventing fermentation and the consequent evolution of foul air. The principal inconvenience attending this method is the dampness of the ships; an evil for which the author suggests various remedies.

“Experimental Researches on the conducting powers of wires for Electricity; and on the heat developed in metallic and liquid conductors.” By the Rev. William Ritchie, L.L.D., Professor of Natural Philosophy in the Royal Institution of Great Britain, and of Natural Philosophy and Astronomy in University College, London.

In a former communication, published in the Philosophical Transactions for 1833, the author endeavoured to show that the quantity of voltaic electricity conducted, or the force of the current, was a function of a greater number of variables than had been previously

supposed. As the theory which he proposed for estimating the conducting powers of substances has been controverted by M. Lenz, he has been induced to reconsider the subject, and finds reason to be satisfied with the correctness of his former views. He farther finds that with feeble magnetic needles the deflecting forces are not proportional to the force of the current, but approach nearer and nearer to that proportion by increasing the magnetic power of the needles ; a result which the author thinks is strictly deducible from the universal law of nature, that the attraction mutually exerted by two bodies is measured by the sum of their masses. He shows that the formula of Ohen, expressive of the conducting powers of wires, and of the resistances which they offer to currents of voltaic electricity, is an approximation to the truth only in the case of feeble currents, and that with the same metal, the conducting powers are not as the lengths of the wires.

The author next inquires into the relation between the heat developed, which he finds to be, in the same wire, as the square of the intensity of the current ; and in wires of the same diameter, and conducting equal quantities of electricity, it is inversely as the conducting power, or directly as the resistance which they oppose to the current. The facts he has adduced in this paper seem to be at variance with the generally received theory of caloric, and to be in perfect accordance with the undulatory theory.

He concludes by describing an experiment confirming the views he has elsewhere advanced with regard to the difference between the physical, the physiological, and the chemical effects resulting from the employment of coils formed of wires of different lengths, being dependent on the time required by the conductor for returning to its natural state.

“ On the Ipoh or Upas poison used by the Jacoons and other aboriginal tribes of the Malayan Peninsula.” By Lieut. T. S. Newbold, Aide-de-Camp to Brigadier-General Wilson, C.B. Communicated by P. M. Roget, M.D., Sec. R.S.

The author gives an account of the process by which the Jacoons, an aboriginal tribe inhabiting the mountains and forests of the Malayan Peninsula, prepare the poison applied to the points of the slender arrows which are propelled from the *Simpitan* or blow-pipe. Three preparations are employed for this purpose, distinguished by the names of *Krohi*, *Tennik* or *Kennik*, and *Mallaye* ; the last of these is more powerful than the other two, and is obtained from the roots of the *Tuba*, the *Perachi*, the *Kopah*, and the *Chey*, and from that of the shrub *Mallaye*, whence it derives its name. The *Krohi* poison is prepared from the root and bark of the *Spoh* tree, and the roots of the *Tuba* and *Kopah*, with the addition of red arsenic and the juice of limes ; and the *Tennik* from the same ingredients, omitting the *Kopah* root. A few experiments are related, made by the author with a view to ascertain the effects of the poisoned arrows on living animals, from which it appears that the train of symptoms commence in a few minutes after the infliction of the wound, and

terminate fatally with more or less rapidity, according to the size of the animal.

"Della Velocità del Vento. Memoria diretta alla Regali Società di Londra per essere iscritta nelle Transazioni filosofiche, et pel concorso del premio annuale di fisica: di Luigi Dau, Dottore in Matematica e Fisica." Communicated by Charles Konig, Esq. For. Sec. R.S.

The author endeavours to investigate the relation which he believes exists between the velocity of the wind and the oscillations of the barometer, and thence to derive rules for calculating the former from observations of the latter.

"Considérations physiques sur le passage Nord-ouest;" by the same. Communicated by the Right Hon. the Earl of Minto, G.C.B. F.R.S.

The author of this memoir, considering that the practicability of a North-west Arctic passage must depend on the mean summer atmospheric temperature of the most northern point of the continent of America being above that at which the congelation of sea water takes place, applies himself to the determination of these temperatures. The results of his calculations are given in a table, exhibiting the extreme and the mean temperatures of the atmosphere for each of the summer months, from May to September, at all degrees of latitude, from 60° to 80° inclusive. According to this table, the temperature of zero, which is about the freezing point of sea water, prevails, at 60° of latitude, on the 10th of May; at 61° lat. on the 20th of May; at 63° , on the 1st of June; at 65° , on the 10th of June; at 67° , on the 20th of June; and at 71° , during the whole of the months of July and August. The author concludes that navigators can reach, without danger of being obstructed by ice, the latitude of 71° during these latter months: and that since the American continent does not probably extend beyond 70° north latitude a passage to the North-west is then open. He recommends, however, that instead of attempting it by the dangerous navigation of the polar sea, a coasting voyage between the continent and the numerous islands which exist in that ocean should be undertaken; or, what he thinks still more promising of success, an expedition by land for exploring the country intervening between the Coppermine River and Hudson's Bay.

"Causes de la Variation diurne de l'Aiguille aimantée, de la Lumière zodiacale, des Aurores Boreales, et Méthode simplifiée pour le relevement des Longitudes, Mémoire soumis à la Société Royale de Londres, pour le concours du prix d'Astronomie. Par Demonville."

The author's speculations proceed on the hypothesis he has adopted, that the Sun, Moon, Jupiter and Mars perform a diurnal and perfectly circular revolution round the earth.

"On the elementary structure of the Muscular Fibre of Animal and Organic Life;" by Frederic C. Skey, Esq., Assistant Surgeon to St. Bartholomew's Hospital, F.R.S.

The author having withdrawn the paper bearing the same title

which he had formerly communicated, and which was read to the Society on the 9th and 16th of February last; and having made in it several alterations and additions, consisting chiefly in notices of the discoveries of preceding anatomists in the same field of inquiry, again presents it to the Society with these improvements.

"Sequel to an Essay on the Constitution of the Atmosphere published in the Philosophical Transactions for 1826; with some account of the Sulphurets of Lime;" by John Dalton, D.C.L., F.R.S.

The author communicates in this paper an account of the investigations on the constitution of the atmosphere, which have engaged his attention during a long period of years. He enters into an examination of the comparative advantages of the three methods which are most in use for analysing common air, namely, firing it with hydrogen in Volta's eudiometer, or abstracting the oxygen by means of nitrous gas and quadrisulphuret of lime; and details the precautions to be taken in the employment of each of these methods, and the degree of accuracy to be expected from the results under different circumstances. He then relates numerous experiments made on air obtained from great heights, from which he is led to the conclusion that the proportion of oxygen to azote in the atmosphere on the surface of the earth is not precisely the same at all places and times; and that in elevated regions this proportion is somewhat less than at the surface of the earth, but not nearly so much as the theory of mixed gases would require, and that the reason for this is to be found in the incessant agitation of the atmosphere produced by winds and other causes.

"Researches on the Tides. Eighth Series. On the progress of the Diurnal Inequality-wave along the coasts of Europe." By the Rev. William Whewell, F.R.S., &c.

In the seventh series of these researches, the author pointed out the laws which the diurnal inequality of the height of high water follows, and showed that those laws are modified so as to exhibit very remarkable differences at different places, and to occasion some difficulty in conceiving the mechanical propagation of the tide-wave. He then suggested what appeared to be a possible solution of the difficulty; but as this suggestion was founded on facts from a few places only, he resolved to attempt to trace the progress of the wave which brings the diurnal inequality on some of the coasts, on which simultaneous observations were made at his request in June 1835; and the present memoir contains an account of the conclusions to which he has been led by this investigation. The details which he gives of the observations made, with this view, at nineteen different stations, appear to establish the conclusion, that the differences of diurnal inequalities at different places are governed by local circumstances, and do not form a progressive series.

"Note on the Fluctuations of the Height of High-water due to changes in the Atmospheric Pressure." By J. W. Lubbock, Esq., F.R.S.

The author verified, both at Liverpool and at London, the existence of a fact similar to that which M. Daussy had ascertained at Brest, namely, the rise of the ocean when the barometer is depressed; and remarks that the correction due to changes in the atmospheric pressure is by no means inconsiderable. He suggests the question whether the surface of the ocean rises in narrow seas simultaneously with the depression of the barometer, or otherwise. With a view to the solution of this question, he gives a tabular diagram showing the correspondence between the calculated and the observed heights, in their relation to the heights of the barometer at Liverpool and at London, from which it would appear that the effect of changes in the atmospheric pressure on the tide is immediate.

“On an improved mode of constructing Magnets.” By James Cunningham, Esq., Member of the Cork Scientific and Literary Society. Communicated by North Ludlow Beamish, Esq., F.R.S., President of that Society.

The material recommended by the author for the most economical, as well as effectual method of constructing magnets, is cast iron, which should be formed in small castings in the form of a horse-shoe, each weighing about seven ounces; these he finds, on being touched in the usual manner by a small compound magnet, received and retained the impregnation better than any which he had previously constructed of steel.

The Society then adjourned over the long vacation, to meet again on the 16th of November next.

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